

5 ENVIRONMENTAL PROGRAMS

The overarching objective of NREL's Environmental Management System and its component programs is responsible stewardship of the environment on its DOE-owned sites, leased properties, and to the extent practicable, on subcontractor and partner sites as well. NREL strives to protect the natural environment by minimizing or eliminating any adverse environmental impacts resulting from NREL activities. The Laboratory's EMS is integrated with other NREL management systems and applies to all research and operations activities. The EMS includes written environmental protection policy and program implementation documents. These are put into practice at all staff and management levels.

NREL's EMS includes components to address waste, air, water, site natural and cultural resources, and land and soil issues, among others. Descriptions of the components of the EMS are provided in the following sections of this chapter. Sections are organized by resource. Each section is comprised of three areas of discussion: a summary of the environmental management of the resource, a discussion of any relevant permitting, and finally a summary of significant activities that have occurred throughout the year.

A summary of NREL's permits, registrations, and notifications are presented in Appendix A. These permits are discussed in the relevant sections below.

5.1 Air Quality Protection

5.1.1 Program Management

Management in this area is consistent with the following NREL programs: Environmental Permitting and Notification (6-2.1), Air Quality Protection (6-2.5), Ozone-Depleting Substances Management (6-2.6), and Particulate Emissions Control for Construction (6-2.14).

Criteria, Hazardous, and Non-Criteria Pollutants

The Clean Air Act and State of Colorado laws and regulations delineate several main categories for air pollutants:

- Criteria air pollutants (e.g. carbon monoxide, nitrogen oxides, sulfur dioxide, particulate matter, ozone, and lead)
- Non-criteria pollutants (e.g. ammonia, hydrogen sulfide, pesticides, organic compounds, metallic compounds, and corrosives)
- Hazardous air pollutants (e.g. includes organic compounds, metals, corrosives, asbestos, radionuclides, and pesticides)
- Ozone depleting substances (e.g. chlorofluorocarbons or "freons")

There are notification and permitting thresholds for criteria, hazardous, and non-criteria pollutants. The primary potential sources of these pollutants at NREL include boilers, emergency generators, experimental laboratory hoods, pilot scale research projects, and small pieces of equipment with gasoline or

diesel engines. NREL maintains air emission inventories to track potential air emissions and identify whether notification and permitting could be required for a particular facility or activity. Fugitive particulate emissions from construction activities occurring on NREL's sites are also a potential source.

Ozone Depleting Substances

Facilities that service refrigeration equipment containing ozone-depleting substances (ODSs) are required to file an annual notification with the Colorado Department of Public Health and Environment (CDPHE). EPA-certified technicians must service this equipment, and NREL has certified technicians on staff that perform this type of service.

Another requirement of the State of Colorado's CFC program is that all refrigeration equipment larger than 100 hp that uses ODSs be registered with CDPHE. NREL has a total of three chillers that are registered with CDPHE, two located at the Solar Energy Research Facility (SERF) on the STM Site, and one at the DWOP.

Halon-based fire suppression systems previously used at NREL were eliminated by 1999, with all supplies of Halon being transferred to other DOE facilities for "banking".

Street Sanding

CDPHE regulations require federal, state, and local government facilities to track wintertime street sanding, and to make efforts to minimize sand use. NREL complies with this requirement and files an annual sanding report with CDPHE. During the period of October 2002 to May 2003 NREL used 31 tons of sand during 13 sanding episodes. During the period of October 2003 to May 2004, NREL used 20 tons of sand during 10 sanding episodes. NREL maintains 4 lane-miles of roads.

5.1.2 Permitting

Most potential sources of air emissions from NREL laboratory and facility operations in 2003 were small scale and did not require permitting. Permitting thresholds are generally 50, 500, 1000, or 2000 pounds, depending on the pollutant. Projected emissions for these sources were either below thresholds for air permitting or the state reviewed the operation and determined emissions to be negligible in terms of impacts to the environment.

Two site-wide permits for particulate emissions from construction areas have been issued to NREL by CDPHE. . NREL has held such permits for a number of years. New site-wide permits were issued in February 2005 to replace previously-held permits on which the time period of applicability had expired. One permit covers the STM site, and the other is in effect for the NWTC. Requiring construction subcontractors to follow control measures identified in

a Particulate Emissions Control Plan controls particulate air emissions. NREL also holds one air emissions permit for an experimental pilot process in the FTLB on the STM Site.

5.1.3 2004 Activities

No APENS were filed in 2004.

5.2 Drinking Water

5.2.1 Program Management

Management in this area is consistent with the following NREL Programs: Drinking Water (6-2.3) and Environmental Permitting and Notification (6-2.1).

Drinking water is provided to NREL's STM and DWOP sites by a public water supply, Consolidated Mutual Water Company. Water to the Joyce Street and ReFUEL Facilities is also provided by a public water supply. NREL supplies drinking water to its NWTC by trucking in water from the Boulder public water supply through a subcontracted water hauler. NREL stores the water on site in a buried 15,000-gallon storage tank and an above ground 2000-gallon tank. The water hauler fills the 15,000-gallon tank, and water is pumped on demand to the 2000-gallon tank, where it is distributed to the Industrial User Facility (IUF) and Building 251.

Disinfection boosting is performed at the NWTC using a chlorine disinfection system.

Testing for bacteria, chlorine levels, haloacetic acids and trihalomethanes (disinfection by-products), lead, and copper is performed at the NWTC according to the requirements of CDPHE. NREL qualifies for reduced lead and copper monitoring. Current state requirements for NREL's site are as follows:

- Bacteria – monthly
- Lead and copper – triennially
- Chlorine levels – weekly, or more frequently as needed
- Haloacetic acids (HAA5) – annually
- Trihalomethanes (TTHM) - annually

All samples are taken from one of the taps connected to the system. No coliform was detected in any of the samples taken during 2003. Quarterly reporting is provided to the State for chlorine residuals.

Monitoring for lead and copper was completed as scheduled during the summer of 2002. All samples collected were well below the action levels, and

sampling according to NREL's reduced monitoring plan with CDPHE was not to be required again until the summer of 2005. However, the State requested NREL collect lead and copper samples in 2004 and 2005. All lead and copper levels were below action levels.

Chlorine residual monitoring of the NWTC drinking water system began with the installation of the chlorine disinfection system in 2000. Monitoring is performed to ensure the chlorine residual levels are detectable, with a target concentration of at least 0.2 mg/L of chlorine present to provide sufficient disinfection at the taps for both Building 251 and the IUF. The state requires that chlorine residual monitoring occur when collecting bacterial samples (monthly). NREL monitors chlorine residual levels in the system on a weekly basis and also measures chlorine levels of drinking water that is delivered to the NWTC.

If any treatment is performed on supplied drinking water, state regulation requires that a State-licensed operator supervise the treatment. NREL hires a subcontracted operator with a Class A license to supervise the disinfection and filtration operations and to perform the necessary sampling.

5.2.2 Permitting

NREL has a Public Water Supply Identification Number (PWSID) issued by CDPHE for the drinking water it provides at the NWTC. This identification number does not require periodic renewal, but periodic testing and record keeping is required in connection with the PWSID. No identification is needed for NREL's STM, DWOP, JSF, or ReFUEL sites, as water is piped from a municipal supplier, and NREL does not alter or treat the water in any way.

5.2.3 2004 Activities

Water sampling in the FTLB, on the STM Site, was initiated in November 2001 in an attempt to isolate the root cause of poor taste with the water supply. Samples were analyzed for total organic carbon, total coliform, nitrate, nitrate + nitrite, sulfate, turbidity, chromium, copper, iron, nickel, lead, zinc, residual free chlorine, and total alkalinity. There were no materials detected in the sampling that would have affected taste; it is hypothesized that reservoir conditions in 2001 could have been responsible for the poor taste. As a result of this sampling, however, lead was detected in two samples. NREL investigated the lead detection in the potable water supply as a separate issue.

In-depth sampling for lead was completed in April and May of 2002, and based on those results, it was determined that lead contamination was not a pervasive problem throughout the FTLB domestic plumbing system. Lead was not detected in the samples representing water coming into the building

through the water main or the service connection that carries water from the water main to the building. Samples representing the plumbing upstream of the individual outlets were non-detectable or very low. In most cases, lead sources appear to be within the outlets or the plumbing leading from the outlets to the lateral piping.

As a result of these findings, AquaPure AP1L3 filters were installed where lead contamination was considered to be a risk for potable water, and sink hardware was changed in several locations. Subsequent monitoring for lead at the FTLB was conducted on a quarterly basis throughout 2003. That sampling verified the effectiveness of the filters and hardware change-outs. In 2004, semi-annual sampling was conducted in February and July, with no lead detected above EPA action levels. Therefore the sampling frequency will be decreased to every 12 months for future sampling.

At the end of 2003 chlorine residual testing at the NWTC indicated that chlorine was dissipating too rapidly within the water distribution system. After investigation, NREL determined this was the result of decreased water usage from proactive water saving measures implemented in 2002.

An engineering solution was developed to increase water flow through the piping via a recirculation loop on the system. This involved increasing the amount of chlorine being added to the system, while recirculating water that is in storage in the piping prior to its distribution at potable outlets. This solution was implemented in 2004.

In May 2004, one of the routine bacteriological samples tested positive for coliform. The required follow-up samples were collected and analyzed, with no detection of bacteria.

5.3 Ground Water Protection

5.3.1 Program Management

Management in this area is consistent with NREL's Groundwater Protection Program (6-2.4).

Because of the sensitive nature of the ground water resource, NREL is careful to evaluate all outdoor projects to attempt to eliminate their potential to impact ground water quality. If there are any materials used that could pose a potential ground water risk, the Laboratory typically insists that safeguards to protect ground water be established, such as secondary containment for equipment that could have the potential to leak oil, double wall tanks with leak detection for diesel fuel storage for NREL facilities' emergency generators, and bermed areas to contain experimental materials.

Ground water characterization was begun on the STM site in 1990 with the installation of a monitoring well network. Eight wells were installed at the base of the mesa slope. Four wells were installed upgradient of NREL development in order to provide an indicator that contaminants were not being transported onto the NREL site, and four wells were placed in a generally downgradient direction to verify that NREL activities had not adversely affected ground water quality. Quarterly sampling was performed for five calendar quarters, followed by annual sampling for three years. There was no evidence of contamination found. In addition, routine follow-up sampling was done in 1997. Three of the initial eight wells were closed (in accordance with state requirements) due to construction activities in 1993, and a fourth was found to be inaccessible during the 1997 sampling, presumably also due to construction activity in the area. Therefore follow-up samples were only collected from four of the original monitoring wells: three upgradient wells and one downgradient of NREL development. No evidence of contamination was found in the 1997 sampling.

NREL has not conducted groundwater monitoring at its leased DWOP site, as there have been no activities that pose an unusual risk to groundwater quality. If NREL had reason to suspect a groundwater quality problem, the issue would be addressed with Denver West Management. DWOP management contracted with an engineering firm to conduct a cursory groundwater monitoring study in 1988 adjacent to the NREL-leased buildings. Two monitoring wells were drilled. There were no detections of significant levels of contaminants.

The NWTC currently has no open or active groundwater wells. There was a water supply well that provided water to Building 251 when DOE's Rocky Flats Office operated the site. In 1993, NREL collected one round of water samples from this well and the associated water distribution and treatment system for the purpose of determining the most feasible alternative for water supply to the site. Based on the sampling results, it was determined that the maintenance and repairs required to make the existing well and treatment system effective were extensive, and there was an indication of the potential for trace organic compounds in the water. Therefore, when DOE's Golden Field Office assumed landlord responsibility for the site in 1993, the connection between the building and the well was severed. The water supply well was plugged and abandoned in accordance with state regulations by an NREL subcontractor in 1996. Potable water is currently transported to the site, as described in section 5.2. NREL has not done any other groundwater sampling at the site. Groundwater sampling will be conducted if future activities pose a risk to the groundwater quality.

There has been no ground water study performed by NREL at the JSF, as NREL has not conducted any activities at the site that pose an unusual risk to ground water. All activities at the site are conducted inside the facility with the exception of routine deliveries and pick-up of inventory stored in the

warehouse. No ground water studies have been performed by NREL in proximity to the ReFUEL facility, as it is located in a heavily industrialized area and NREL has not had any releases to the environment that would pose a risk to groundwater.

There is currently no ongoing routine ground water monitoring program on any NREL site, because, with one exception, there have been no activities identified that currently or historically posed a significant risk to ground water. The one occurrence that had the potential to impact ground water was a diesel leak to the environment in June 1998 from a failed check valve on the PDU emergency generator above ground storage tank at the Alternative Fuels User Facility. The majority of contaminated soil was excavated and removed from the site for disposal at a permitted landfill. Three ground water monitoring wells were installed at the site in September 1998, one upgradient, and two downgradient. No hydrocarbon contamination was detected in the ground water during the initial sampling of the three wells, nor during follow-up sampling conducted in March and September 1999, and March 2000. Based on the results of these follow-up samples no further samples will be collected.

5.3.2 Permitting

All ground water monitoring wells installed by NREL at the STM site have been permitted with the Colorado Department of Natural Resources. Abandonment paperwork has also been filed with the State of Colorado for the three wells that were plugged in 1993.

5.3.3 2004 Activities

Plans are being developed to close the three monitoring wells installed in September 1998.

5.4 Wastewater Discharge

5.4.1 Program Management

Management in this area is consistent with NREL's Waste Management and Minimization Program (6-2.8).

The majority of wastewater from NREL's STM and DWOP facilities flows into the Pleasant View Water and Sanitation District's system and ultimately to Metro Wastewater Reclamation District's (Metro) treatment plant. There is a small septic system consisting of a tank and absorption field, on the mesa top serving the Solar Radiation Research Laboratory (SRRL), because there is no sewer line to the mesa top. Wastewater from the JSF and the ReFUEL Facility also flows to Metro's treatment plant. The NWTC is not connected to a sewer

system, but has two septic systems that include tanks and absorption fields for the treatment of wastewater.

It is NREL policy that hazardous chemicals are not to be discharged to the sewer system, and NREL staff are trained in this policy. In addition, NREL sites have design criteria for waste drains in lab areas to minimize the possibility of a hazardous material discharge. These criteria include measures such as secondary containment for any chemicals used near sinks in laboratory exhaust hoods, no floor drains in laboratory areas unless a specific need can be shown, and caps for any floor drains that are installed in lab areas. New research and operations activities as well as ongoing activities that undergo significant modifications are reviewed for their potential effect on wastewater character through NREL's risk assessment process.

5.4.2 Permitting

No permitting for the majority of NREL's wastewater discharges is required. NREL has no direct wastewater discharges to the environment at the DWOP, ReFUEL or JSF, so no National Permit Discharge Elimination System (NPDES) permitting is necessary. NREL maintains three individual sewage disposal systems, two at the NWTC and one at the STM site. The remainder of NREL facility wastewater is discharged to Metro through the sanitary sewer system. NREL facilities are currently classified by Metro as non-industrial water users at these sites. As non-industrial users, NREL sites do not need a permit from Metro for sewer discharge, and monitoring for pollutants in wastewater is not required.

NREL maintains septic permits from Jefferson County (an authority delegated to the counties under a State of Colorado program) for the NWTC IUF septic system as well as for the SRRL facility on the STM site mesa top.

5.4.3 2004 Activities

There were no new significant activities during 2004 in this area.

5.5 Surface Water Protection (Storm Water and Erosion Control)

5.5.1 Program Management

Management in this area is consistent with the following NREL Programs: Storm Water Pollution Prevention for Construction Activities at the STM, and Storm Water Pollution Prevention for Construction Activities at the NWTC (6-2.15 and 6-2.16, respectively)

Limited storm water monitoring was conducted at the STM site during the summers of 1992 and 1993 to characterize surface water quality at NREL's

existing level of activity at that time, and to confirm that NREL's activities were not adversely impacting storm water quality on the STM site. Sampling indicated that NREL's activities are not resulting in contamination of storm water runoff.

No storm water monitoring has been conducted at NREL's other sites. In 1998, surface water samples were taken in two drainages at the NWTC in connection with NREL's weed control efforts. No traces of the herbicide applied to weed-infested areas were detected in the water samples.

Outdoor research projects are reviewed during the planning stages, through NREL's NEPA and risk assessment processes, for potential impacts to surface water. Measures to prevent such impacts are incorporated, as appropriate, into the design for each project. Such control measures could include secondary containment and bermed areas where chemicals will be used, or installation of a cover or roof to protect chemical use and storage areas from precipitation and adverse weather conditions.

Storm Water Pollution Prevention Plans (SPPP) have been written for construction activities on both the STM and NWTC (6-2.15 and 6-2.16, respectively). Erosion and sediment controls are implemented according to the plans, and periodic site inspections are conducted to verify that the controls are functioning properly and to identify any repairs to the erosion and sediment controls that are needed. Written reports are issued for each inspection, with corrective actions assigned to responsible staff when necessary. The SPPPs also provide for prompt revegetation of disturbed areas. Provisions of the SPPPs are implemented through coordination with NREL's construction subcontractors.

5.5.2 Permitting

NPDES notification for storm water discharges on federal facilities in Colorado is under the jurisdiction of the Environmental Protection Agency (EPA). NREL is currently covered under EPA's general permit for storm water discharge associated with construction activities on the STM and NWTC sites. Both Midwest Research Institute, as operator, and DOE, as site owner, have filed Notices of Intent for appropriate construction activities on the STM and NWTC Sites. No permits are required for NREL's routine operations.

5.5.3 2004 Activities

In 2003 there were a few research-related and paving construction projects for which erosion and sediment control programs were developed. These were minor in terms of the extent of soil disturbance. The only major project during 2003 was the construction of a natural gas pipeline at the NWTC. The project began in late 2003 and was completed in early 2004. Reseeding was

completed, and revegetation is considered complete as of September 2004. A Notice of Termination of coverage under the EPA's Construction General Permit for this project was filed with EPA in August of 2004.

5.6 Waste Management

5.6.1 Program Management

Management in this area is consistent with the following NREL Programs: Waste Management and Minimization (6-2.8), and Environmental Permitting and Notification (6-2.1).

Hazardous wastes are handled and disposed according to the Resource Conservation and Recovery Act (RCRA). NREL facilities' waste profile consists of a broad range of hazardous laboratory chemicals in small quantities. Chemicals in solid or liquid form are collected in each laboratory or at each experimental site. These wastes are periodically collected from the laboratories and prepared by the NREL ES&H Office for off-site disposal.

Treatment and disposal is conducted at EPA-permitted treatment, storage, and disposal facilities. In addition, NREL facilities have adopted a conservative waste disposal policy in which materials that are not regulated by RCRA, yet pose a potential hazard, are collected and disposed of as non-hazardous material at a RCRA-permitted disposal facility.

NREL facilities also generate low-level radioactive wastes. This waste normally consists of personal protective equipment, disposable lab ware, scintillation fluids, and water-based liquids. Radioactive waste is shipped off-site for disposal on an as-needed basis.

5.6.2 Permitting

NREL has five separate sites that have the potential to produce limited quantities of hazardous materials. Each of the five sites has a Resource Conservation and Recovery Act (RCRA) waste generator identification number issued by the State of Colorado. The South Table Mountain and Denver West Office Park locations are classified as "small quantity generators," generating less than 1000 kg of waste per month. The other three sites, the Joyce Street Facility, the National Wind Technology Center, and the ReFUEL Facility, are classified as "conditionally exempt small quantity generators," generating less than 100 kg of waste per month.

5.6.3 2004 Activities

In calendar year 2004 NREL shipped 12,113 pounds (5,506 kg) of hazardous waste, and 1,495 pounds (680 kg) of non-RCRA regulated waste for disposal.

These quantities are approximations only. The materials are normally not weighed when picked up by disposal or recycling vendors. Typically, a vendor will provide its good faith estimate of quantity based on practical experience.

There was no radioactive waste shipped for off-site disposal in 2004. Information regarding the types and quantities of radioactive materials used at NREL facilities is detailed in Section 5.15.

In 2004, NREL participated in the DOE Materials Exchange program by sharing the list of chemicals available for redistribution with other DOE facilities. This effort may contribute to waste reduction within the DOE organization.

5.7 Storage Tanks (Underground and Above Ground)

5.7.1 Program Management

Management in this area is consistent with the following NREL programs: Aboveground Storage Tank Management (6-2.7) and Spill Prevention Control and Countermeasures (6-2.10)

NREL facilities store diesel for emergency generator and research use in aboveground storage tanks. NREL's tank management program focuses on proper tank design, operation, and inspection to protect against spills and leaks. The program is designed to meet regulatory requirements, and it is more stringent than the regulations require in many areas.

Several important safeguards have been incorporated into NREL's tank management program to prevent any accidental releases of diesel fuel from the storage tanks. These safeguards include both mechanical safeguards, such as double wall tanks with sensors that result in an alarm if the inner tank wall is leaking, overfill and spill protection; and procedural safeguards such as written operating procedures and tank filling procedures. All tanks larger than 110 gallons are visually inspected at least once per month.

Due to the quantity of diesel fuel stored on the STM site, a Spill Prevention Control and Countermeasures Plan is required to be in place. This Plan describes the site topography and neighboring areas, and outlines the steps necessary to mitigate any spills or leaks of diesel fuel. To date, NREL has not had any offsite impacts related to tank activities.

5.7.2 Permitting

Tanks larger than 660 gallons require registration with the State of Colorado, with the registration renewed annually. Currently, only two tanks meet the registration threshold, the SERF emergency generator diesel storage tank and

the Process Demonstration Unit (PDU) ethanol storage tank at the Alternative Fuels User Facility (AFUF), both located on the STM site.

5.7.3 2004 Activities

There were no spills or leaks from NREL tanks during 2004. There was no state inspection in 2004.

5.8 Hazardous Materials Management

5.8.1 Program Management

Management in this area is consistent with the following NREL programs: Chemical Safety Program (6-4.6), and Asbestos Management Program (6-4.18)

No active or abandoned hazardous waste sites have been identified on any of the Laboratory sites. Therefore, many sections of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) do not apply to NREL facilities.

NREL facilities are subject to the emergency reporting requirements in Title III of the Superfund Amendments and Reauthorization Act (SARA), also known as the Emergency Planning and Community Right-To-Know Act (EPCRA). Section 302 of these regulations requires a facility to notify the State Emergency Response Commission (SERC) that it is subject to emergency planning and notification requirements if any chemicals in the facility's inventory are stored in quantities greater than prescribed threshold planning quantities (TPQs). NREL facilities first became subject to planning and notification requirements in 1988.

EPCRA Section 304 requires facilities to immediately notify the Local Emergency Planning Committee (LEPC) if there is an accidental spill or release of more than the predetermined reportable quantity (RQ).

According to Section 311 and 312 of EPCRA, NREL provides Material Safety Data Sheets (MSDSs) for chemicals that are stored on-site in quantities greater than TPQs, and provides inventory reporting for these same chemicals in the form of Tier I or Tier II reports to emergency planning and response groups.

NREL provides additional emergency response and reporting information to the Jefferson County Emergency LEPC, the SERC, and West Metro Fire Protection District when requested. The Jefferson County LEPC uses Uniform Fire Code hazard categories and threshold reporting quantities rather than those specified in SARA Title III, resulting in a larger number of individual hazard categories and lower reporting thresholds. NREL has an active involvement in the emergency planning concepts of SARA Title III, in that the

Laboratory currently has two acting members on the Jefferson County LEPC, and has been represented since the LEPC's inception.

The Laboratory is also subject to reporting requirements in the event of a release of an RQ of any hazardous substance listed by EPCRA. EPCRA Section 313 requires that a toxic chemical release inventory report (Form R) be filed with EPA for any chemical that is manufactured, processed, or otherwise used in quantities exceeding Threshold Planning Quantities (TPQs). Although NREL is not a manufacturing facility and does not fall within any of the Standard Industrial Classification (SIC) codes for which Section 313 reporting is required, Executive Order 12856 requires all federal facilities to file a report, if applicable, regardless of SIC code.

Section 112r of the Clean Air Act regulates numerous toxic and flammable substances, and threshold quantities are established under Section 112r of the Clean Air Act. All thresholds are 500, 100, 2500, 500, 10,000, 15,000, or 20,000 pounds, depending on the material. The threshold quantity applies to the quantity of substance in a single process, not at the facility as a whole.

NREL has a Laboratory-wide chemical management system that serves as a centralized chemical inventory as well as a tool for managing and reporting on chemicals used at the Laboratory. Using an electronic bar-coding system, the CMS tracks chemicals from the point of receipt through end-use and disposal. The system also contains technical data and reporting information for many of the chemicals in the CMS database. Key functions of the system include:

- Providing current inventories by room, building, and/or site
- Improving research efficiency and minimizing hazardous waste generation by allowing staff to determine if needed chemicals are already available on site prior to making chemical purchases
- Providing quick access to chemical inventories and hazard information during emergency responses
- Facilitating accurate and efficient reporting to external agencies (e.g. fire districts, EPC, EPA, DOE)

To maintain the CMS database, a physical inventory of each lab and work area in which chemicals are used or stored is conducted periodically.

NREL has not identified any areas within its facilities that contain residual contamination requiring special decommissioning. Asbestos surveys have been conducted in a number of NREL facilities: Joyce Street Facility; Building 251 at the NWTC; Building 16, and at the STM Site the AFUF (only older areas of the building), FTLB and SRRL. No asbestos was found at the Joyce Street Facility and the AFUF. The other facilities have limited amounts of asbestos-containing material in areas such as floor tile, lab countertops, caulking and sealants, and roofing material. Asbestos-containing materials are

left undisturbed whenever possible. If renovation is planned that will disturb asbestos-containing material, then certified asbestos removal contractors are used and strict asbestos removal procedures are followed. An Asbestos Management Program is in effect for all NREL facilities.

5.8.2 Permitting

NREL obtains annual Hazardous Material Permits from West Metro Fire Protection District for the STM and DWOP sites. The permits are required by the West Metro and are issued by building. NREL obtains permits for a total of six buildings where hazardous materials are stored and/or used. Prior to issuing the permits, a representative from West Metro conducts a walk-through inspection of the entire South Table Mountain Site and DWOP.

5.8.3 2004 Activities

West Metro conducted a walk-through inspection of NREL's STM and DWOP facilities in the spring of 2004. Annual hazardous materials permits for the six buildings were issued following the inspection. West Metro provided a few recommendations as a result of that inspection. Recommendations included: placarding buildings outside of TTF if they contain batteries, and placing a placard on the door to the hazardous waste storage room in Building 16.

The CMS was used to provide complete chemical inventories for each facility to West Metro when applying for Hazardous Materials Permits in 2004. The CMS was also used to post individual laboratory chemical inventories on the ES&H website, which were updated monthly.

In 2004, NREL had three chemicals on-site in quantities that exceeded the TPQs: sulfuric acid, hydrofluoric acid, and hydrogen selenide. The proper MSDSs and Tier II forms were submitted to state and local emergency response organizations and the local fire department.

In 2004, NREL facilities had no release exceeding the RQ of any reportable material under EPCRA.

As a research and development Laboratory, NREL does not manufacture or process any materials, and during 2004, the Laboratory did not use any materials on the Section 313 list in quantities exceeding the 4536-kg (10,000-lb) threshold planning quantity.

5.9 Pollution Prevention & Sustainability

5.9.1 Waste Minimization, Recycling, and Green Purchasing (Purchasing Materials With Recovered Content)

As a facility that focuses on the research, development, and deployment of renewable energy and energy efficiency technologies, NREL is committed to responsible environmental stewardship. A significant part of this effort is pollution prevention. NREL's Waste Management and Minimization Program outlines pollution prevention principles that are consistent with the EPA's hierarchy of preventing or reducing pollution at the source; recycling or reusing waste materials that cannot be prevented; and environmentally safe treatment and disposal of waste that cannot be prevented, recycled, or reused.

The current pollution prevention program includes training on waste handling, waste minimization, and methods to eliminate releases to air, soil, or wastewater. In addition, the ES&H Office integrates pollution prevention awareness into NREL activities in a number of ways. The proposed use of chemicals in projects are evaluated prior to use during project planning reviews, Safe Operating Procedure reviews, and Readiness Verifications conducted according to NREL's Hazard Identification and Control Program (ESH 6-6.2). During these reviews, NREL staff evaluates opportunities for chemical substitution as well as methods of reducing the volume of chemicals used and waste streams generated.

The use of bankcards for chemical purchases has been another means of reducing the volume of chemicals purchased, stored and disposed at NREL. Under the bankcard chemical purchasing system, a small group of chemical users are given privileges to order chemicals directly from the vendor using their bankcards. Because bankcard purchasing expedites chemical purchases over conventional purchasing processes at NREL, users order only the chemicals required for use in the immediate future, knowing that additional quantities can be quickly acquired if needed. The ES&H Office reviews all chemical purchases made using the bankcards.

Recycling and reuse activities are important components of NREL's pollution prevention program. A crosscutting committee comprised of staff from around the Laboratory, and led by Sustainable NREL manages NREL's recycling program. Items currently recycled or reused at NREL include the following:

- computer monitors
- fluorescent bulbs
- batteries
- styrofoam peanuts and other packing materials
- freon from refrigerator units
- scrap metal
- wooden pallets
- laser printer cartridges
- aluminum and tin cans
- glass

- plastics (1 & 2 only)
- newspaper
- white and mixed paper
- corrugated cardboard
- boxboard
- books and magazines
- transparencies, and
- tyvek envelopes

Fourteen central recycling locations are available for most recycling needs throughout NREL facilities. NREL also offers a chemical redistribution program where chemicals in original containers are made available to staff at NREL and other DOE facilities to be reissued for research activities at no cost. The NREL CMS is used for redistributing chemicals to new users.

In 2004, NREL generated 266 metric tons of solid waste and diverted 82 metric tons to recycling, or 31% of the total. Data for some of the materials recycled by NREL during 2004 follow. Quantities listed below are those entered into the DOE Pollution Prevention database, which tracks recycling on a fiscal year (October 1 through Sept. 29) basis. Data are for fiscal year 2004. Quantities are not tracked for all materials that are recycled; therefore, the list below does not include all recycled materials.

Batteries	2,038 lb
Fluorescent bulbs	356 lbs
Mixed metal	105,100 lb
Commingled containers	29,204 lb
Cardboard	23,400 lb
Misc. paper	128,032 lb
Computer monitors	3,194 lbs

NREL also performed an analysis of its solid waste stream to determine the recyclable content. It was determined that some 30% of the waste stream was recyclable material. This analysis serves as the basis for defining the focus of recycling activity for FY2004 and beyond.

When possible, NREL purchases products with recovered content. In 2004, some of the products purchased containing recovered content included carpeting, uncoated-printing paper, and toner cartridges. One hundred percent (100%) of NREL's supply of uncoated printing and writing paper, and toner cartridges purchased in 2004 contained recovered content.

5.9.2 Vehicles

Transportation at the Laboratory falls into three main categories: fleet vehicles, air travel, and employee commuting. Figure 5.1 illustrates a percentage

breakdown of transportation by mode. In an effort to describe the impact that transportation has on the footprint of the Laboratory, a calculation was done illustrating the kilograms of CO₂ emitted into the atmosphere. Fifteen percent of NREL's total footprint was due to transportation. This breakdown serves as a way to examine NREL's transportation issues and proactively provide solutions to reduce the impact of transportation.

Sustainable NREL's Transportation strategy is directed by two Federal guidelines. The first, EPACT of 1992 states that 75% of the light duty vehicle (LDV) fleet shall be Alternative Fuel Vehicles (AFV). Secondly, Executive Order 13149, Greening the Government through Federal Fleet and Transportation Efficiency and DOE compliance strategy for this Executive Order states that there shall be a 20% decrease of fleet petroleum use by 2005 as compared to a 1999 baseline. In order to meet these goals, NREL's fleet currently has 36 AFV's in their total fleet of 47 vehicles. This decreased our petroleum use to 7691 gallons in FY04. This is far exceeding the goal that DOE had set for NREL of 9800 gallons or less by FY05. The Laboratory is converting its fleet to 100% AFVs as soon as possible given their availability for leasing through the General Services Administration. Laboratory fleet transportation vehicle types include 19 ethanol (E85), 9 compressed natural gas bi-fuel (CNG/bi), 4 CNG, 15 petroleum-fueled (11 regular unleaded and 4 diesel [1 leased]) vehicles (1).

The Laboratory has made a major commitment to the use of bio-based fuels in its fleet. Forty percent (40%) or 19 of the 47 fleet vehicles are fueled by e85. The Laboratory was an early adopter with its first e85 vehicles entering the fleet in 1997. The fleet used 11,645 gallons of e85 and biodiesel in FY04. This represents some 71% of the total fleet usage of 16,405 gallons of total gas and equivalent fuel. Although we are actively using e85-fueled vehicles, biodiesel is also an option being explored. As of this date, NREL will fuel a Kubota tractor, a Gradall lift and a Ford 555 backhoe with biodiesel B20 fuel as a pilot project.

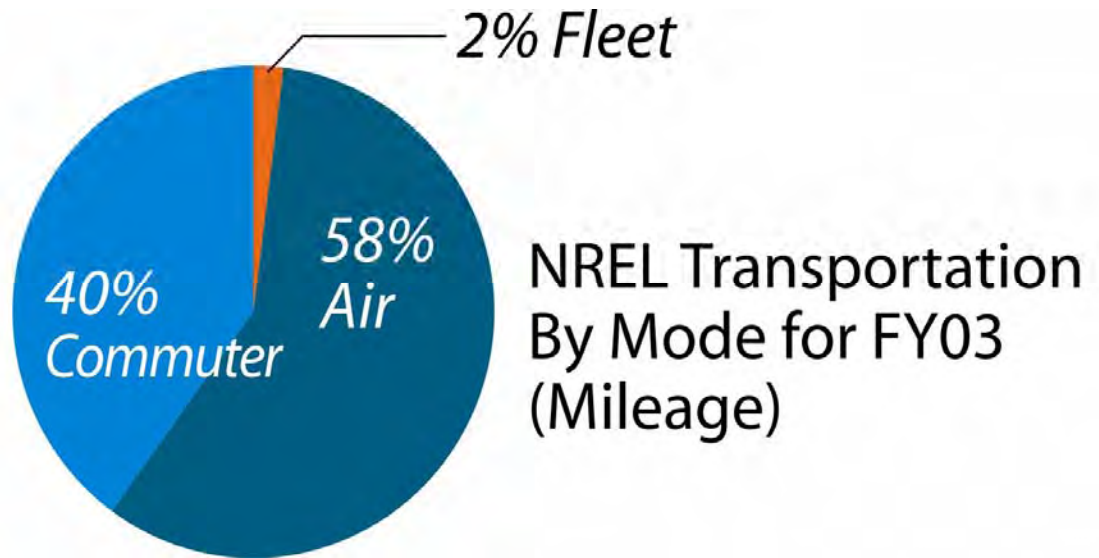
Fleet vehicles are only part of the transportation initiative at the Laboratory. Sustainable NREL also actively encourages alternative commuting for employees. In the spring of each year, employees receive an on-line survey regarding their commuting habits. In FY04, 375 employees out of 942 responded. 132 of the respondents use alternative modes of commuting. While these numbers are strong, there are ways to improve them. For instance, NREL offers bus passes to all full-time employees. In FY04 alone, 59 employees reported taking public transportation at least three times a week. NREL also works actively with the Denver Regional Council of Governments to provide employees with carpool and vanpool resources. 150 employees participate in car-pooling. Additionally, as of April of 2004, 38 employees had purchased hybrid vehicles for their personal automobile.

Biking and walking are also viable commuting options for NREL employees living within a reasonable proximity and the Laboratory wants to make these easy options for all who choose them. NREL has showering facilities, locker rooms, and bike lockers on-site. Bike vests were given to our bike commuters for an added measure of safety. External biking programs are also promoted such as Colorado's Bike to Work Day in June of 2004. NREL had 75 employees who participated. In FY04, 53 employees biked regularly and 13 walked.

Air travel is also a concern for NREL. The Laboratory has two offices, one in Golden, Colorado the other in Washington, DC. Employees were able to decrease air travel back and forth from these two offices by utilizing teleconferencing equipment. In FY04 alone, approximately 31 trips were saved due to the use of video and/or phone conferencing. While air travel at some point is always necessary for Laboratory business, there are ways to reduce it.

The Laboratory also addresses future campus planning with transportation in mind. In 2003, NREL published its General Development Vision. This is a 25-year framework for developing campus facilities. The transportation piece of this plan includes an inner shuttle loop and an exterior service road. Parking will be consolidated and will only have 1500 parking spaces.

Figure 5.1: NREL Transportation by Mode



5.9.3 *Energy*

NREL has already met the 2005 and 2010 Federal requirements for reduction in energy use per square foot in laboratory and industrial facilities using a DOE 1990 baseline. The baseline is the average for all DOE Laboratory and Industrial Facilities in 1990. For NREL, this baseline is 352,540 BTU/SF and will be applicable to NREL facilities from 2002 forward.

Table 5.1 includes the FY 1990 baseline and summarizes the energy consumption per gross square foot for Total NREL facilities, which includes both the South Table Mountain and National Wind Technology Center sites.

Table 5.1 – Energy Consumption

	BTU/GSF
FY1990 BASE YEAR	352,540
FY2001 TOTAL NREL (DOE-owned)	271,247
FY2002 TOTAL NREL (DOE-owned)	270,495
FY2003 TOTAL NREL (DOE-owned)	257,887
FY2003 TOTAL NREL (w/ Wind Source Credit)	240,525
FY2004 TOTAL NREL (DOE-owned)	256,650
FY2004 TOTAL NREL (w/ Wind Source Credit)	239,289

Comparing total NREL energy consumption in FY 2004 to the baseline, the energy consumption is 27% lower than the FY 1990 baseline. In addition, the total NREL energy consumption with Wind Source Credit is 32% lower than the FY 1990 baseline.

Individual Building Metering & Individual Energy Saving Program. NREL previously received gas and electrical utility billing from the utility company, Xcel, on a monthly basis for NREL's two sites. The electrical utility billing was not broken down into individual buildings within each site; Xcel only provided the total electrical power consumption and billing data for the entire site. In 2002, NREL completed installation of individual power meters at each major facility on the STM and NWTC sites. Individual metering will allow better understanding of energy use and identify further opportunities for energy use and peak demand reductions.

In 2004, NREL's efforts were focused on organizing the metering data and making it accessible to NREL management, building managers, and building occupants as a method of providing feedback on building energy use. As a result of these efforts, all individual building metering information is on an energy performance data website on the NREL intranet. The website contains information about current and historical energy use patterns. A program to educate building occupants on energy saving opportunities is also being implemented. The objective of providing feedback and education on energy saving opportunities is to reduce energy use at the individual level.

In addition to improving the organization and accessibility of energy use data, in 2003 NREL also installed an energy analysis software package that is used to identify opportunities to reduce peak power demand using the site metering data. A more robust demand management program will be implemented using this analysis software and site metering data to secure additional peak demand savings.

Building Energy Retrofits. In 2003, two upgrades to existing building systems were made to improve energy efficiency and reduce energy use: SERF exhaust fan upgrades and installation of a SERF processed water heat exchanger.

Prior to the upgrade, SERF exhaust systems in the west and center wings introduced dilution air into its exhaust system to maintain duct static. With the installation of variable speed drives on the exhaust fans in the west and center wings, the dilution air was reduced and allowed the fan to operate at a lower speed, which reduced energy consumption.

The chilled water plant feeds the SERF's process-cooling load. Adding a heat exchanger between the process cooling load and the heat recovery system provides free cooling which will minimize the usage of the chilled water from the chiller and reduce energy consumption by 20,000 therms/year.

Energy Efficiency Specifications for Renovations/New Construction. NREL has always emphasized significantly greater levels of energy efficiency than federal standards with all of its DOE-owned buildings, with a goal to reduce energy use by 30% compared to the federal standard reference for building

systems at 10 CFR 434. Energy efficiency criteria have been incorporated into the established NREL design standards and specifications for all construction projects. All new buildings must meet, at a minimum, Leadership in Energy and Environmental Design (LEED) Silver criteria, established by the U.S. Green Building Council. In addition, all new laboratory buildings are designed according to the principles of the Laboratories for the 21st Century Program. See the "Sustainable Building Design" section below for more detailed information.

Computer/Monitors Purchasing. NREL Information Services (IS) provides a standard hardware list of recommended Energy Star products for PC and MAC computers, monitors and peripherals. Staff is encouraged to purchase Energy Star hardware items through the "Basic Ordering Agreement" (BOA) contracts. Supplier's websites provide energy information for standard products. Flat panel monitors, that use significantly less energy than standard monitors, have been added to NREL's standard supply list and are the priority purchase recommendation.

Computer Power Management. A computer power management project was begun in 2001. The project involved piloting computer power management software to centrally control implementation of aggressive suites of power management settings and automatically shut down computers at prescribed times at the end of workdays and on weekends. Baseline data collection using this tool was completed. Implementation of the tool on a Laboratory-wide basis is now institutionalized and is installed on each computer through out the Laboratory. NREL has also developed a web-interface so that computer power management data for individual computer, organizational, and Lab-wide use is available.

Printers and Copiers. Networked printers are configured automatically to enter a low-power mode of 15-45 watts or less after a period of inactivity (this time period differs with models). Seventy-one duplex modules were purchased in FY 2001 and installed on network printers configured to default duplexing. Users can control one-sided printing through the applications print feature. All copiers are Energy Star rated.

5.9.4 Renewable Energy

Self-generated electricity. NREL generates about 58,000 kWh of electricity from grid-connected PV panels each year. These panels are located at the Solar Energy Research Facility, the Site Entrance Building, the Outdoor Test Facility, NWTC Site Entrance Building and DER Test Facility, and remote applications including signs, walkway and parking lighting. The National Wind Technology Center (NWTC) has approximately 1,600 kW of installed wind turbine capacity used for research purposes. When the turbines are running, the energy that they produce is used to offset simultaneous NWTC site energy use. The turbines produce over 80,000 kWh per year, most of which is used to offset simultaneous NWTC site energy use. The total self-generated electricity at NREL is over 138,000 kWh each year.

Purchased renewable energy. In FY2004, NREL purchased 1,981,200 kWh of wind-generated electricity from the local utility company, Xcel Energy. This purchase represents about 10% of NREL's annual electrical usage. NREL has committed to purchase another 1,981,200 kWh of wind-generated electricity for FY2004 and will be negotiating agreements for FY2005 and beyond.

5.9.5 Water Conservation

In 2002, NREL completed a Water Efficiency Plan that also identifies and ranks available water savings best management practices (BMPs) in accordance with the Federal Energy Management Program (FEMP) guidelines. In fiscal year 2002, one BMP was implemented: NREL installed low-flow toilets, waterless urinals, and low-flow showerheads in 100% of existing facilities. In fiscal year 2003, NREL implemented the Public Information and Education Programs and Water Efficient Landscaping BMPs at 100% of DOE-owned buildings. In FY2004, NREL implemented two more BMPs: 1) Cooling Tower Management (changing the chemical to water ratio); and 2) Distribution System Audits, Leak Detection and Repair.

Water use data for the STM site is obtained from the water supply company, Consolidated Mutual Water. All of the facilities that require water on the STM site have dedicated water meters. There are also water sub-meters on all three cooling towers at the STM site.

The NWTC site is a remote site that has no wells or water supply. Boulder Public Water Supply water is delivered weekly to the NWTC, as described in Section 5.2. Currently water usage at the NWTC is measured by the amount of water delivered to the site.

The water use for all NREL sites is summarized in Table 5.2. Water consumption was 24% lower in FY2003 as compared to FY2000 base year.

Table 5.2 – Water Consumption

	Million Gallons per Year (MGY)
FY2000 (BASE YEAR – TOTAL NREL)	12.9
FY2002 – TOTAL NREL	10.9
FY2003 – TOTAL NREL	9.8
FY2004 – TOTAL NREL	7.0

5.9.6 Sustainable Building Design

Several of NREL's buildings, including the Thermal Test Facility (TTF) and Solar Energy Research Facility (SERF) are models of energy efficiency. The SERF's annual energy costs are 40 percent below that of a similar building designed to meet federal energy standards, and the TTF operates on 63 percent less energy than a building designed to meet the Federal Energy Code. The TTF building received a 2002 Federal Energy Saver Showcase Award.

Construction began on the Science and Technology Facility (S&TF) in early 2005. The facility has been designed at the LEED Gold Level. Its projected energy cost reduction is 50% better than the requirement for federal facilities (10 CFR 434). The S&TF is a Laboratories of the 21st Century Pilot Partner Project.

NREL staff designed the NWTC Site Entrance Building (SEB) in-house. The building was designed to be a near zero energy building; its systems are fully monitored. The NWTC SEB is 16'x 10', and uses NREL technologies to reduce the power demand of the building. Such technologies include daylighting, passive solar heating, good thermal envelope, natural ventilation through the windows, low-e windows, overhangs for shade control, a Trombe wall, occupancy and daylight sensors, high-efficiency lighting with dimming fixtures, and the use of energy efficient flat screen computer monitors. These technologies, along with a roof mounted 768 W photovoltaic array, and two 1000 W wind turbines, reduce the amount of electricity drawn from the utility grid and feed excess electricity produced back to the grid.

5.9.7 Technical Assistance and Outreach

Outreach by Leadership. NREL staff developed a Sustainable Design Guide for Los Alamos National Laboratory. NREL FEMP staff have assisted in developing both Energy Management and Water Management Plans at NREL. In addition, NREL FEMP staff developed the Department of Commerce agency-wide energy plan and are in the process of assisting several other agencies in their energy planning processes. NREL researchers work with DOE, EPA, the US Green Building Council, and others on a variety of assistance and outreach programs and activities related to energy and water use. Examples include standards development, conferences, classes and workshops, tours, publications, websites, and energy and water analysis software. NREL's activities in this regard can be surveyed through the most recent Institutional Plan or Performance Assessments, accessible on NREL's website (www.nrel.gov).

Outreach by Recognition. As a component of its outreach efforts to disseminate information regarding sustainability, NREL has received a number of awards. Examples of these awards are: CU Wirth Chair Award in Environmental and Community Development Policy, DOE Departmental

Energy Management Achievement Award: Effective Program Implementation – Sustainable NREL, and DOE Best-In-Class Pollution Prevention Awards. In 2004, the latter award was specifically for Sustainable NREL’s New Buildings Program; Recycling Program; and Education, Outreach, and Information Sharing Program.

Internal and External Outreach. NREL has produced a number of publications with the goal of sharing the details of NREL’s Sustainability Program with staff and the public. These include the Sustainable NREL Pioneer and NREL NOW, internal electronic publications; and an NREL Sustainability Report that is distributed both internally to NREL staff and to the public. Also as part of Sustainable NREL’s internal outreach program, in 2004, the Laboratory began implementation of a webpage with an enhanced suite of sustainability tools for employees; for example, tools that address alternative commuting, computer power management, and CO₂ emissions equivalents from employee activities and laboratory operations.

5.10 Vegetation

5.10.1 Program Management

Management in this area is consistent with NREL’s Weed Management Programs for the STM and NWTC (6-2.12 and 6-2.13, respectively) and the Sustainable Landscape Design and Management Program (6-2.19).

NREL’s basic philosophy regarding vegetation is to conserve the ecosystems on the site in their natural state as much as possible. There is some landscaping using non-native drought-tolerant species adjacent to some of the buildings, and even a few areas of bluegrass at the STM site. However the native vegetation and natural character of the landscape is maintained over the majority of the site. Revegetation of areas to be left in their natural state following disturbance from construction or other outdoor activities is conducted using a native seed mix of grasses and forbs. This mixes are site-specific and are comprised predominantly of natives that were originally present on the site before disturbance. That seed mix and revegetation procedures are outlined in NREL’s Storm Water Pollution Prevention Programs for the STM and NWTC Sites. The use of native species is required at both the STM and NWTC whenever feasible. When possible, replacement of high water demand species, like Kentucky bluegrass, with drought-tolerant species is encouraged.

A vegetation survey of the STM site was conducted in support of the 1993 site wide Environmental Assessment, and a site reconnaissance was performed by Dames & Moore biologists in November 1997 (U.S. DOE, 1998, page 3-1).

In 1999, a verification survey of STM site vegetation was performed on the Conservation easement property to identify any changes to habitat character or species types that may have occurred since the 1993 and 1997 surveys. An effort was made to determine whether any sensitive species or habitats that could potentially support such species were present on the site. No sensitive species or potential habitats were identified on the STM site.

A vegetation survey of the STM was conducted between June 2001 and May 2002. Five general habitats were described on the STM site, comprising seven plant communities (Plantae Consulting Services, 2002). No rare or imperiled plant species were found on the site. Areas of mixed foothills shrublands (also called tall upland shrubland) were identified on top of the mesa within the Conservation Easement area. This natural community is listed as rare and imperiled by the Colorado Natural Heritage program. No development will occur in the Conservation Easement area.

Eleven noxious weed species were located on the STM site. Four of these belong to Colorado's top ten prioritized-for-control weed species. These four include Canada thistle, diffuse knapweed, field bindweed, and musk thistle.

A three-season vegetation survey of the NWTC site was performed between August 1999 and August 2000. The survey defined five general habitats on the NWTC site, comprising nine plant communities and 271 vascular plant species (Plantae Consulting Services, 2000). Figure 5.2 illustrates a portion of the NWTC site and shows the diverse vegetation mix present. No rare or imperiled plant species were found on the site. However, the survey identified a small area of xeric tallgrass prairie (defined as mesic mixed grassland in this study) located in the southwest corner of the NWTC. This natural community is listed as rare and imperiled by the Colorado Natural Heritage Program. This listing implies no legal designation or regulatory enforcement. It is so designated primarily for management purposes. This area of the NWTC is not impacted by research or construction activities on the site.

Figure 5.2 - Lush vegetation growth along the NWTC north fenceline.



The survey identified eleven noxious weed species on the NWTC site. Five of these are recognized as belonging to the top ten prioritized weed species in Colorado: Canada thistle, diffuse knapweed, field bindweed, musk thistle, and leafy spurge. Based on the survey, recommendations were made to continue using a comprehensive weed management program, based on integrated pest management (IPM) philosophy.

The survey showed the native seed mix used for revegetation at the NWTC to be very successful in many areas of the site. NREL is continuing the use of this seed mix for revegetation at the NWTC.

Weed control efforts have been ongoing since 1997 at the NWTC and 1998 at the STM site. NREL uses an IPM approach that incorporates various types of weed control methods. Some of these include mechanical practices (e.g. mowing), cultural (e.g. reclamation of disturbed areas), prevention (e.g. limiting or eliminating driving of vehicles off established roadways), and herbicide treatment. The effectiveness of control methods is periodically assessed. The use of multiple strategies for control has been successful in significantly reducing populations of diffuse knapweed and Canada thistle on the sites. The key aspect of the weed control program is to maintain flexibility to respond to the changes in weed populations from year to year.

In 1998, aerial herbicide application of Tordon 22K was conducted using helicopter application over about 200 acres of the NWTC to target diffuse knapweed. It was very effective in controlling the weed, and healthy stands of native grasses have proliferated with the decrease in weed competition. Since that time, infested areas of the NWTC have been treated using ground application with herbicide. More information regarding 2003 herbicide application is provided in Section 5.10.3.

Weed infestations at the STM site are much less severe than at the NWTC. Limited ground application of herbicides has been conducted at the STM since 1998.

5.10.2 Permitting

There is no permitting applicable to vegetation management, although there is a State weed law that requires property owners to control certain species of invasive weeds (e.g. diffuse knapweed). For application of certain types of herbicides designated as “restricted use” by EPA, a certified applicator must be used. Herbicide applications at NREL are always performed by a certified applicator. The exceptions are herbicides used for control of undesirable vegetation along walkways, roadways, and adjacent to facilities. These are typically Round-Up and Weed-B-Gon and are applied by NREL Site Operations staff according to an NREL Safe Operating Procedure (SOP).

5.10.3 2004 Activities

NREL routinely practices IPM using various weed control methods, as described in the previous section. These are implemented during the normal course of site operation. In addition to the reclamation, off-road driving restrictions, and other weed control methods, ground applications of herbicides occurred at the NWTC in the spring of 2004 and 2005. Very limited herbicide application was conducted on the STM site in the spring of 2004 and 2005, focusing primarily on areas adjacent to roadways and buildings. The spraying was performed using a four-wheel drive vehicle. Primary target weeds were diffuse knapweed, leafy spurge, Canada thistle, common teasel, and hoary cress at NWTC. At the STM, target weeds were mainly diffuse knapweed and Canada thistle.

NREL promotes the sustainable management of its government-owned land by practicing environmentally sound, cost-effective landscaping practices that reduce adverse impacts to the natural environment while providing essential shade and cooling for indoor and outdoor spaces and a more aesthetically appealing appearance for the sites. This commitment is implemented by a Sustainable Landscape Design and Management Program.

5.11 Wildlife

5.11.1 Program Management

Wildlife habitat at the STM site is comprised of grasslands, shrublands, and wetlands. The STM site provides vegetation types for a variety of wildlife species including birds, mammals, and reptiles and amphibians. The variety of vegetation types present on site attracts species that may use the site as year-round habitat, for breeding only, during migration, or as winter habitat.

A wildlife survey was conducted on the STM sites in 1987. Follow-up verification surveys were conducted in 1998 and 1999. A new site-wide wildlife survey has just been completed, and is described in Section 5.11.3.

Field research into avian use of the NWTC was conducted during 1994 and 1995 in an effort to identify potential impacts on birds from wind-turbine research. While several species of raptors, including red-tailed hawks, kestrels, and a great-horned owl were noted on the site, they were primarily transient in nature. The survey indicated that the NWTC appears to be used primarily for resting and hunting, although one pair of kestrels nested in an old concrete pole during the spring. Birds of prey of concern, such as eagles, generally fly in excess of 152 m (500 ft) over the site. No significant impacts to the birds from NREL activities were found during the survey.

A year-long monitoring project for birds and bats was initiated on the NWTC in early 2001. Standardized plot surveys were conducted to survey songbirds

and raptors on the NWTC and adjacent, undeveloped areas. NREL also conducted systematic searches of turbines and meteorological towers on the NWTC to document avian mortality. The study was completed in July 2002. Salient findings of the study were as follows (Schmidt, E., *et al.*, 2003):

- Abundances of individual raptor species on the NWTC site were similar to surrounding areas. However, the average number of species detected per count at the NWTC was nearly double that of surrounding areas in winter, the season when raptors are most abundant in the region. This difference is likely attributable to increased availability of perches at the site. Raptors flew and perched higher at the NWTC than in adjacent areas, again probably related to the wind turbines and other structures at the site.
- Only 1 of 46 bird species counted on grassland plots during this study differed in abundance between the NWTC and adjacent areas – the horned lark, which was about 16 times more common off site. This difference is attributable to cattle on Boulder Open Space creating low-stature grasslands preferred by this species.
- Bird abundance and variety on the...[newly acquired 25-acre parcel, south of the previous NWTC boundary] slated for future use were generally similar to the developed areas, except for the relative scarcity of raptors on the undeveloped site, which probably was due to a lack of perches.
- The NWTC does not support a large diversity or abundance of bat species (possibly six species of bats use the site), but an area on the northwest side of the site, with trees close to a rocky outcrop, provides foraging and perhaps roosting habitat.

No raptor carcasses [were found] during the 12-month survey of the NWTC except one American kestrel that had died before the study started. Bird mortality associated with the site appears to be minor. Extrapolating from four passerine (songbird) carcasses found during the searches, estimated annual bird mortality attributable to the NWTC was 24 individuals, all songbirds (Passeriformes). Most of these deaths were probably the result of collisions with support wires for the meteorological towers rather than the turbines themselves. No evidence [was found] of bat fatalities at the site.

5.11.2 Permitting

A scientific collection license was obtained from the Colorado Division of Wildlife for the small mammal trapping portion of the recent STM wildlife survey. NREL has no other permitting requirements for this area of environmental management.

5.11.3 2004 Activities

A site-wide wildlife survey of the STM site was begun in April 2004 and was completed in June 2005. The objectives of the survey were to update existing data in light of expanded development of both the site and the surrounding area, and to develop best management practices for future construction projects to maximize protection for site wildlife.

The survey included large and small mammals, predators, migratory birds and raptors, upland game birds, and invertebrates identified on an opportunistic basis (i.e. only as they are found during other surveys).

A listing of species observed during the year-long STM wildlife survey is attached as Appendix B. A summary of the survey results follows:

Migratory Birds and Raptors

Many species of migratory birds were observed on the STM site, with many of these species potentially nesting on site. In addition, the STM site may provide important migration and winter habitat for migratory birds. For example, the American tree sparrow was only observed on site during Winter surveys and the northern harrier was observed hunting on site only in the Fall and Winter seasons. Several species were only observed during the Fall season including downy woodpecker, red-breasted nuthatch, blue jay, loggerhead shrike, and rock wren, suggesting that these species may use the STM site as a stopover during migration. Habitat for migrating birds is important, as some of these species may migrate as far south as Central and South America.

Several species of raptors were observed at the STM site and, two species were observed by both studies (1987 and 2004-2005) nesting on site, the red-tailed hawk and the American kestrel. Both of these species were observed hunting on site during the 2004-2005 surveys, in addition to the Cooper's hawk. The NREL STM site provides habitat and a prey base of small birds and small mammals for these raptor species. Species such as the Swainson's hawk migrate thousands of miles each year, wintering as far south as Argentina, and returning to the western United States and Canada to breed. Areas such as the STM site may provide a prey source for the Swainson's hawk and other species during migration.

Large Mammals

Mule deer at the STM site have been observed in all habitat types. Mule deer were often observed in the amphitheater drainage or in the tall shrubland on the slope. When approached on the mesa top, the mule deer tended to move away from the disturbance and into the amphitheater drainage. The tall shrubland vegetation type may provide important hiding cover for this species. Spring pellet group surveys resulted in nearly double the amount of pellet groups and plots the pellet groups were observed in than Fall surveys. This may suggest that winter use of the STM site by deer may be higher than summer use or that

deer utilize different habitats on site for these periods as affected by the availability of habitats and the location of survey plots, although the single year of data is not sufficient to draw conclusions regarding seasonal variation.

Predators

Coyotes are one of the most widespread and adaptable carnivores in North America and occur at all elevation levels and in all ecosystems in Colorado (Fitzgerald et al. 1994). Lagomorphs (rabbits) and rodents are an important part of the coyote's diet, both of which are abundant on the STM site. Evidence of predation on cottontail rabbits (i.e., entrails and fur) was observed during site visits. Coyotes may breed on the STM site as two potential dens were observed on site in two of the site drainages.

Small Mammals

The deer mouse is the widest ranging and commonest small mammal in North America (Fitzgerald et al. 1994) and based on the 1987 and 2004-2005 survey data, it is also the most common small mammal on the NREL STM site. Deer mice can occur anywhere where cover occurs (Fitzgerald et al. 1994) and were observed in the four vegetation types sampled on the STM site. This species is a generalist and is known to exploit disturbed habitats. Mexican woodrats and prairie voles were more restricted than the deer mouse in the habitats they occupied on the STM site. Mexican woodrats are associated with rocky slopes and do not build dens away from rocky areas (Fitzgerald et al. 1994). This species is therefore limited as to where it can occur on the STM site. Prairie voles are adapted to the grasslands, constructing burrows and runway systems throughout the grassland, essentially limiting this species to the short grass and mixed grass vegetation types on the STM site. All of these species are active throughout the year. Winter surveys (2004-2005) were conducted during a warm weather trend, which may have contributed to the highest number of small mammals caught compared to the three other surveys.

Reptiles/Amphibians

Several rattlesnakes were observed on the STM site, more often in rocky areas, but also in the grassland. A rattlesnake den may be present in the rocks near the top of the mesa slope north of the Visitor's Center (near E-2-3) as four rattlesnakes were observed within a few feet of each other, one in the open and three in a rock crevice. Hibernation generally occurs in rock outcrops, with this species usually active from mid-April through late-September (Hammerson 1999). Although only three species of reptiles and one species of amphibian were observed on the STM site, no specific survey methods were employed to identify or count these groups of wildlife at STM.

To avoid or minimize disturbance to wildlife species on site, site-wide best management practices (BMPs) were developed as a result of this survey for consideration during ongoing normal site operations and future construction projects. The BMPs address migratory birds and raptors, mammals, all

wildlife, and general site operations. They will be applied as appropriate to site activities and future site development.

Some of the STM Site wildlife species are shown on the photos in Figures 5.2, 5.3, and 5.4.



Figure 5.3 – Raccoon napping in the shade of the SERF On the STM site.



Figure 5.4 – In the photo on the left, a rattlesnake rests in the leaf litter. On the right, a bull snake and a rabbit take shelter from the heat of the day under staff cars in one of the STM parking lots.



Figure 5.5 – A long-tailed weasel peaks out from underneath the CNG cylinders on the STM site. In the photo on the right, a rare sighting of an amphibian; a tiger salamander.

5.12 *Endangered Species/Species of Concern*

5.12.1 *Program Management*

The Endangered Species Act provides for the designation and protection of wildlife, fish, and plant species that are in danger of extinction and preserves the ecosystems on which these species depend. For the purposes of site wildlife surveys, a species of concern is defined as those species protected under Federal statutes, including the Endangered Species Act of 1973, as amended, the Bald Eagle Protection Act of 1940, as amended, and the Colorado Division of Wildlife list of endangered, threatened, and wildlife species of concern. Federal agencies are also required to abide by the Migratory Bird Treaty Act of 1918, as amended, but for this report, these species are not included as species of concern. For plant surveys, the Colorado Natural Heritage Program designation is also considered. Although this listing of rare species is not regulatory in nature, NREL uses it for management purposes.

No threatened or endangered species or candidate wildlife species for endangered designation or other sensitive species have been found on either the STM or NWTC sites during any site wildlife surveys. . Likewise, no threatened, endangered, candidate, or other sensitive plant species were identified in any survey of the STM or NWTC sites, as there was no suitable habitat present for any of the sensitive species.

The vegetation survey at NWTC, conducted between August 1999 and August 2000, identified a small area of xeric tallgrass (defined in the survey as mesic mixed grassland) prairie located in the southwest corner of the NWTC site. This natural community is listed as rare and imperiled by the Colorado Natural Heritage Program. This listing implies no legal designation, but is made primarily for management planning purposes. This xeric tallgrass prairie area has been designated by NREL as a Conservation Management Area. Most of the Conservation Management Areas on the NWTC are formally designated as areas on which building will not occur. However, as the xeric tallgrass prairie is in the active turbine testing area, it is not reasonable to preclude all development on portions of the site inhabited by this plant community; but disturbance will be minimized on the area.

The vegetation survey completed on the STM site in May 2002 found no rare/or imperiled plant species on the site, but areas of mixed foothills shrublands (also called tall upland shrubland), were identified along the top of the mesa within the Conservation Easement area. That natural community is listed as rare and imperiled by the Colorado Natural Heritage program. It is within a designated conservation easement area where no development will occur except planned trails being established by Jefferson County Open Space (See Section 6.0 for a discussion of trails).

5.12.2 Permitting

NREL has no permitting requirements for this area of environmental management.

5.12.3 2003 Activities

As reported in Section 5.11.3, a site-wide wildlife survey of the STM site has recently been completed. No species observed on the STM site during the 1987 or the 2004-2005 wildlife surveys were present on either agency's list. However, golden eagles were incidentally observed on the STM site (outside of raptor surveys) and are protected under the Bald Eagle Protection Act. Golden eagles were observed flying over the site and may use the site for hunting. No golden eagle nests or nesting activities were observed on the STM site.

5.13 Wetlands/Floodplains

Limited wetland areas totaling less than 0.3 ha (0.75 ac) occur on the STM site in the drainage bottom located north of the Visitor's Center. These are narrow, linear wetlands supporting spikerush, baltic rush, sedges, bluegrass, hemlock, and field mint. These wetlands will be protected from adverse impacts as site development continues.

Wetland areas at the NWTC are extremely limited in extent as well. These areas, along the site's eastern boundary, total less than 0.4 ha (1 ac).

According to maps generated by the Jefferson County Department of Highways and Transportation as part of its urban drainage studies, NREL's STM site does not contain any floodplains, and no floodplains have been identified at the NWTC. As a best-management practice, however, all construction activities that may cross a drainage channel are designed to meet the 100-year flood control standards (designed to withstand the equivalent of a 100-year flood).

5.14 Cultural Resources

5.14.1 Program Management

Cultural resources are defined as any prehistoric or historic district, site, or building, structure, or object considered important to a culture, subculture, or community for scientific, traditional, religious or any other reason. Cultural resources can be divided into three major categories:

1. Prehistoric and historic archaeological resources.
2. Architectural resources.
3. Traditional cultural resources.

Prehistoric and historic archaeological resources are locations where human activity measurably altered the earth or left deposits of physical remains (e.g., arrowheads, bottles). Prehistoric resources that predate the advent of written records in a region range from a scatter composed of a few artifacts to village sites and rock art. Historic resources may include campsites, roads, fences, trails, dumps, battlegrounds, mines, and a variety of other features.

Architectural resources include standing buildings, dams, canals, bridges, and other structures of historic or aesthetic significance. Architectural resources generally must be more than 50 years old to be considered for protection under existing cultural resource laws. However, more recent structures, such as Cold War facilities, may warrant protection if they manifest the potential to gain significance in the future.

A traditional cultural resource can be defined as a property that is eligible for inclusion in the National Register because of its association with cultural practices or beliefs of a living community that are rooted in the community's history and are important in maintaining the continuing cultural identity of the community. Traditional resources can include archaeological resources, buildings, neighborhoods, prominent topographic features, habitats, plants, animals, and minerals that Native Americans or other groups consider essential for the persistence of their traditional culture.

Cultural resources are protected under Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended. Significant cultural resources are either eligible for, or listed on, the National Register.

Three formal surveys of historic and cultural resources have been performed on the STM site. These surveys were completed in 1980, 1987, and 2003 (see Section 5.14.3 for more detail about the 2003 survey). Two additional surveys of the Camp George West district involving the STM site have also been conducted.

As a result of these STM surveys, three historical sites were recognized as significant cultural resources that should be preserved. These sites include an open-air amphitheater, a stone bridge spanning a natural drainage channel adjacent to the amphitheater, and a stone and concrete ammunition bunker below the amphitheater site. The three structures were constructed during the Works Progress Administration (WPA) era in the 1930s. Through NREL's efforts, these sites have been added to the National Register of Historic Places (National Register), with the amphitheater and stone footbridge listed together as a single site. NREL also participated in an interagency survey of South Table Mountain and Camp George West to identify historic structures and sites eligible for nomination to the National Register. Figure 1.7 provides an aerial view of the amphitheater.

The Camp George West Historic District, located south of the STM Site's Denver West Parkway, was also listed, and includes the 25-acre parcel recently transferred to NREL. Two architectural resources, firing range lines and low rock walls, have been identified on that 25-acre parcel on NREL's STM Site that contributes to the Camp George West Historic District.

An archaeological survey of the NWTC site was conducted in support of the 1996 Environmental Assessment to supplement previous surveys so there were no gaps in cultural surveys on the site. No significant historical or archaeological resources were identified. However, the wooded ridge area on the west portion of the site was identified as a location with potential for cultural resources, so further testing or observation during excavation would be done should there be any future need for work in the utility corridor in the vicinity of the ridge.

Should any evidence of cultural resources be discovered at any time during ground disturbing activities at the STM or NWTC sites, NREL will stop all work in the vicinity until a qualified archaeologist completely evaluates the significance of the find.

5.14.2 Permitting

NREL has no permitting requirements for this area of environmental management.

5.14.3 2004-5 Activities

The Camp George West Historic District overlaps the NREL STM property by 25 acres. Two contributing resources occur within those 25 acres. Contributing resources are those features within a historic district that contribute to the district's overall eligibility for the National Register.

A 2003 cultural resources survey was conducted of the 25-acre parcel south of Denver West Parkway on the STM Site. The survey found evidence of two contributing features to the Camp George West Historic District occurring within the 25-acre parcel. The contributing resources are as follows:

- Two firing lines located on the 25 acres. There are also firing lines located south of the NREL property on land owned by Jefferson County Open Space and proposed for development as the Camp George West Park.
- Portions of a low rock wall are also present on the 25 acres. There is also a rock wall located south of the NREL property.

DOE consulted with the State Historic Preservation Officer (SHPO) over the resources newly discovered on the 25 acres. DOE and the SHPO entered into a Memorandum of Understanding in which DOE agreed to perform further surveys to fully document the resources on the 25 acres prior to any development of the parcel.

In 2005, the DOE Golden Field Office and NREL conducted additional surveying of the Camp George West Firing Range Lines and Low Rock Walls, which contribute to the Camp George West Historic District's eligibility to the National Register of Historic Places. The survey resulted in Level II HABS/HAER documentation. The survey will be more fully described in the 2005 ASER.

5.15 National Environmental Policy Act (NEPA)

5.15.1 Program Management

Management in this area is consistent with NREL's NEPA Implementation Program (6-2.2).

As a federal agency, DOE is obligated to comply with NEPA by evaluating the potential for environmental impacts prior to conducting its activities. The Council of Environmental Quality (CEQ) issues regulations for compliance with the Act. DOE has also issued implementing regulations at 10 CFR that complement the CEQ requirements. DOE has written a site wide Environmental Assessment (EA) for its activity at the STM Site and DWOP, and separate EAs for the NWTC and JSF activities.

NREL has established procedures, with the approval of the DOE GO, to assist DOE in meeting their NEPA obligation. Proposed activities that will be conducted off of NREL's four sites are evaluated for their potential environmental effects using the appropriate level of NEPA review, in conjunction with GO.

The NREL NEPA Handbook has been prepared to provide NREL project managers and procurement specialists with guidance on implementing the NEPA procedures, and training is provided to staff, as appropriate.

5.15.2 Permitting

NREL has no permitting requirements under NEPA.

5.15.3 2004 Activities

During 2004, an EA was conducted for a proposed Low Wind Speed Turbine Demonstration Project in Carbon County, Wyoming. The EA process was initiated in October 2004, and a Finding of No Significant Impact was signed in January 2005.

In addition to the EA, numerous NEPA reviews of both onsite and offsite activities occurred through completion of NREL Environmental Checklists. As outlined in NREL's NEPA implementation procedures, these reviews were coordinated with NREL project managers, subcontracting staff, the NREL NEPA Coordinator, and the DOE Golden Field Office NEPA Compliance Officer. NEPA requirements were also coordinated with future program planning through interaction between NREL's ES&H Office Director and NREL's Technology Program and Project Managers, as well as through participation in the NREL management Annual Operating Plan process and other reviews of proposed projects for the upcoming year.

5.16 *Radiological Program*

5.16.1 Program Management

Management in this area is consistent with the following NREL programs: Air Quality Protection (6-2.5), and Radiological Control (6-4.5).

All radioactive material at NREL facilities is handled according to NREL's Radiological Control Program. Elements of the program include a radiological control organization, a radiation safety policy and control manual, safe operating procedures, safe work permits, radiological control areas and postings, monitoring, training, and purchasing controls for radioactive materials.

There are no nuclear operations at NREL sites. All of NREL's radiation sources are used/stored in facilities located on the STM site. These include three x-ray

diffraction machines at the SERF on the STM Site, one x-ray diffraction machine in Building 16 on the DWOP site, and two sealed source level gauges at the AFUF (STM Site) used on pilot scale processes to measure the level of material inside process tanks. In addition, one laboratory at the Field Test Laboratory Building (FTLB), on the STM site, occasionally uses small quantities of radioisotopes for biological or chemical labeling.

The three X-ray diffraction machines located at the SERF are registered with the State of Colorado and are inspected every two years by a state-licensed surveyor. The surveyor inspects and certifies the X-ray machines and audits NREL's program for radiation safety in connection with operating the machines. The one machine in Building 16 was moved from the SERF and is not presently being used.

Monitoring of equipment and facilities for removable contamination is performed in the laboratories where radioisotopes are used. Wipe tests are performed on any laboratory surfaces that could have become contaminated by the radioisotope work at least monthly and more frequently if needed. These wipes are analyzed using a scintillation counter.

U.S. Department of Energy (DOE) Order 5400.5, "Radiation Protection of the Public and the Environment," established radiation emission limits for DOE facilities. Such emissions are also regulated by Section 112 of the Clean Air Act as implemented by 40 CFR 61, Subpart H, established by the U.S. Environmental Protection Agency (EPA). According to 40 CFR 61, Subpart H, all DOE facilities, including NREL, must annually demonstrate compliance with the radionuclide emission limit to the ambient air not exceeding an amount that would result in any member of the public receiving an effective dose of 10 mrem/yr or greater. No radioactive air-emission monitoring is conducted at NREL because of the extremely low usage of radioactive material. Therefore, NREL demonstrates compliance with the National Emission Standards for Hazardous Air Pollutants (NESHAP) in 40 CFR 61, Subpart H, by utilizing the EPA's COMPLY computer model to determine the effective dose equivalent to the public.

All radioactive waste generated during NREL activities is classified as low-level waste. Waste from the STM site is temporarily stored at the Waste Handling Facility (WHF) until disposal is arranged at an offsite facility permitted to accept low-level radioactive waste.

5.16.2 Permitting

NREL does not have a radioactive materials license from the State of Colorado, as the Laboratory is currently under DOE jurisdiction for radioactive materials handling.

5.16.3 2004 Activities

During 2004, the total quantity of radioisotopes used at NREL was 1.812 mCi, used in one laboratory at NREL's FTLB. A laboratory hood exhaust emitted any emissions generated by this work. In addition, much of NREL's radioisotope inventory (including waste quantities) is in containers on which the manufacturer's original seal was broken. In 2003 the potential dose to the public was calculated as though the contents of all unsealed containers was exhausted to the atmosphere, including the amount actually used in 2003. P-32 and S-35 waste that is stored in the Waste Handling Facility and has decayed past ten half-lives was not included in this calculation.

The distance from the source in the FTLB to the nearest potential receptor is 119 m (fence line of nearest resident). For the WHF, the distance from the source to the nearest potential receptor is 311 m.

According to the COMPLY computer model, the potential dose to the nearest member of the public is 0.043 mrem/yr, well below the emission limit of 10 mrem/yr, and NREL is in compliance with the NESHAP for radionuclides. Because the dose is calculated rather than measured, it represents a potential or estimated rather than an actual dose.

The resulting calculated off-site whole body doses are small, but are still likely overestimates of potential radionuclide doses. The COMPLY formula assumes that the entire quantity of the radionuclide in all open containers was released, and that the receptor raises and consumes all his/her own milk, meat, and vegetables at home. These assumptions are extremely conservative.

There were no shipments of radioactive waste for disposal in 2004.

In 2004, there was a modification to the lab where radioisotopes are used: a fan that handles the two chemical fume hoods located in that lab was replaced, and an additional backup fan was installed.

There were no unplanned releases of radioisotopes in 2004.